THE GLOW-WORM *LAMPYRIS NOCTILUCA* L. (COLEOPTERA: LAMPYRIDAE) IN ESSEX

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Abstract. During 2001 and 2002, a detailed survey investigating the distribution and abundance of the Glow-worm *Lampyris noctiluca* L. was undertaken in Essex. Only 13 records existed for this species within the county at the start of the survey, and many of these were old and gave imprecise location details. A simple transect method was utilised to ascertain the abundance of *L. noctiluca* at 12 sites, whilst records of this species since 1992 were collected to determine the current distribution in the county. The survey results suggest a widespread distribution of *L. noctiluca* in Essex and a large number of recorded sites, despite a lack of favourable habitat in the county. However, the transect survey data highlight the uncertain future for this species in Essex. Counts of glowing adult females on the transect walks were generally very low. Some of the smaller populations were isolated by several kilometres from the next nearest occupied site. These colonies are therefore most at risk from extinction, particularly as the available favourable habitat at these sites is limited.

INTRODUCTION

The Glow-worm *Lampyris noctiluca* L. (Coleoptera: Lampyridae) has a widespread but distinctly local distribution in Britain (Tyler, 2002), apparently being more abundant in southern England, especially on areas of chalk downland (Tyler, 1994). This species is predominantly a grassland insect, although it occurs in other habitats such as hedgerows and open woodlands (British Naturalists' Association, 1971). The status of *L. noctiluca* in Britain is poorly documented, however, some efforts have been made to ascertain its national distribution. The earliest of these was a survey conducted by the British Naturalists' Association in the 1960s and early 1970s. It was from this initial survey that a decline in the British *L. noctiluca* population was first suspected; with many recorders noting an apparent fall in numbers (British Naturalists' Association 1971; 1974). In 1991/92, a survey was launched by Robin Scagell (Scagell, 2003), with the aim of both revisiting the sites identified by the British Naturalists' Association survey and investigating previously unrecorded ones.

A survey of Gloucestershire between 1980 and 1990 found *L. noctiluca* to be particularly widespread with a large number of colonies (Alexander, 1992). Particularly favourable areas in Gloucestershire included unimproved limestone grasslands in the Cotswolds, the Forest of Dean and scarp grasslands overlooking Cheltenham and Gloucester. Alexander (1992) states that Gloucestershire is one of the best counties in Britain for *L. noctiluca*, perhaps due to the large area of suitable habitats that are present. However, in Essex, favourable grassland habitats are rare due to the extent of urban and suburban areas, and the main land use of arable production (Essex County Council, 1996). The remaining grassland areas suffer from fragmentation and consequent isolation, which may have a significant impact on a sedentary species such as *L. noctiluca* (Tyler, 1994). This species has been suspected as rather rare in Essex (Corke, 1984), but this may be due to under-recording because

the county recorder has historical records for only 13 sites. Many of these records are extremely old with imprecise location details, for example, 'Hazeleigh Wood 1890s'.

To rectify this under-recording, a detailed survey of Essex in 2001 and 2002 was instigated by the authors in an effort to determine the current distribution of *L. noctiluca* in Essex. In addition to recording the locations of this species in the county, the number of glowing females present at these sites was also recorded using a simple transect method. This paper presents the results of the survey and assesses the impact of isolation and habitat availability in determining the future survival of extant *L. noctiluca* colonies in Essex.

METHOD

Study Sites

A transect was established at each of 12 sites with a known *L. noctiluca* colony to allow the abundance of glowing adult females to be ascertained, thus providing comparative data on population size at different sites. Habitats recorded at the transect sites included ancient woodland and unimproved meadow (Table 1). Several of these sites had legal conservation designations, with four transects on land designated as Sites of Special Scientific Interest (SSSI). The remaining transects were established on unprotected land in the general countryside, including rural roadside verges and scrubland.

Table 1: Characteristics of the transect sites in Essex

Site	Site name	Grid ref.	No. females counted	Designations	Description
A	Benfleet Downs	TQ7885	17	SSSI & SPA	Hillside meadow with fringing scrub
B	Bulford Mill Lane	TL7720	10	—	Roadside verge with mature hedgerow
C	Finches Nature Area	TQ9094	79	—	Scrub with rides and glades
D	Danbury Woods	TL7806	57	SSSI	Ancient woodland with rides and glades
E	Dry Street	TQ6986	11	—	Hedgerow with grassy path
F	Hadleigh Castle	TQ8186	72	—	Rough grassland and scrub around castle walls
G	Hatfield Forest	TL5420	6	SSSI & NNR	Ancient grazed grassland adjoining ancient woodland
H	Iron Latch	TL9526	25	—	Restored meadow with fringing scrub and ancient woodland
I	Marks Hill	TQ6888	5	—	Hedgerow with grassy path
J	One Tree Hill	TQ7086	362	SSSI	A mixture of meadow, scrub and woodland
K	Shut Heath Wood	TL8513	18	—	Ancient woodland with glades
L	Manwood Chase	TM0019	83	—	Meadow, scrub and woodland

NNR, National Nature Reserve
SPA, Special Protection Area

Each transect was at least 100 m in length and was walked once in each of three two-week periods: 9–22 July, 23 July–5 August, and 6–19 August in both 2001 and 2002. Any glowing adult females which were observed along the route were recorded. It was felt that these three periods adequately incorporated the peak glowing season in Essex when most adult females would be displaying. The main disadvantage to using transect counts of glowing females as an estimation of colony size is that females only mate once, after which they stop glowing (Tyler, 2002). Therefore, low numbers of glowing females at a site may indicate successful breeding on previous nights rather than a small colony.

Survey participants were required to commence each walk between 2200 and 2300 h, and to terminate by midnight. However, most walks were started at approximately 2200 h and had finished by 2300 h. Therefore, very few walks finished after 2330 h when females may have 'switched off' for the night. A slow strolling pace was recommended for the walks to reduce the risk of overlooking glowing females along the route. Surveys were not conducted in unfavourable conditions, for example, when it was cold, wet or windy, because counts may be reduced under such climatic extremes (Alexander, 1992).

To analyse the quantity of favourable habitat within the immediate vicinity of each transect route, Ordnance Survey Maps and *Wild Essex* (Gunton, 2000) were consulted. Using the maps and the detailed description of transect sites in *Wild Essex*, the approximate area (in ha) of favourable *L. noctiluca* habitat adjoining each transect route was calculated. Favourable habitats included unimproved meadow, scrub, woodland ride, deciduous woodland, roadside verge and any area of nature reserve. The area of favourable habitat was then related to the distance of each transect colony (in km) from the next nearest *L. noctiluca* population, to ascertain which populations were most at risk from extinction. The authors believe that small, isolated colonies which exist in a limited area of favourable habitat are most likely to become extinct in the future.

Casual records of *L. noctiluca* since 1992 were collected from members of the public in both 2001 and 2002 to determine the current distribution of this species in the county. The survey was widely publicised in various newspapers throughout the county and on BBC Radio Essex. Leaflets were distributed to nature reserve visitor centres and a press release was posted on the Essex Wildlife Trust website and the British Glow-worm page www.glowworms.org.uk. Although the survey therefore involved participants with limited or no entomological knowledge, the distinctive nature of the adult females minimised the likelihood of identification difficulties.

SURVEY RESULTS AND DISCUSSION

Lampyris noctiluca has a widespread but localised distribution in Essex (Fig. 1). This species is scattered throughout most of the county, having occurred at 54 sites in 22 10-kilometre squares (approximately 39% of 10-kilometre squares in Essex) since 1992. In comparison with other counties, Essex has a reasonably high number of *L. noctiluca* colonies. For example, in a 10 year survey of Gloucestershire from 1980 to 1990, 58 colonies were recorded (Alexander, 1992). It would appear that in Essex, *L. noctiluca* only occurs where there are suitable habitats such as unimproved meadow and ancient woodland (Gardiner *et al.*, 2002). The majority of sites where *L. noctiluca* individuals were observed during the survey are managed only by infrequent mowing.

Favourable *L. noctiluca* habitats such as unimproved meadow and ancient woodland are rare in Essex, as the majority of the land area comprises arable,

Figure 1. Distribution of *Lampyris noctiluca* records in Essex since 1992

pasture or urban/suburban habitats (Table 2). These areas are unsuitable for breeding populations of *L. noctiluca*, which tend to favour unimproved grassland (Tyler, 2002). Potentially favourable habitats for this species such as unmanaged rough grassland only comprise approximately 3% of the land area in Essex (Table 2). However, much of this 10800 ha of rough grassland may have been improved for agriculture and may therefore be unsuitable for sustaining breeding populations of *L. noctiluca* which could be due to the low abundance and diversity of larval prey such as snails in these intensively managed agricultural grasslands. The dearth of

Table 2: Total area of selected habitats in Essex

Habitat	Area (ha)	Proportion
Arable/tilled land	199500	0.52
Pasture/mown grassland	84930	0.22
Urban/suburban	45286	0.12
Deciduous woodland	13070	0.03
Rough grassland	10800	0.03
Other	30298	0.08
Total	**383884**	

Data from Essex County Council (1996)

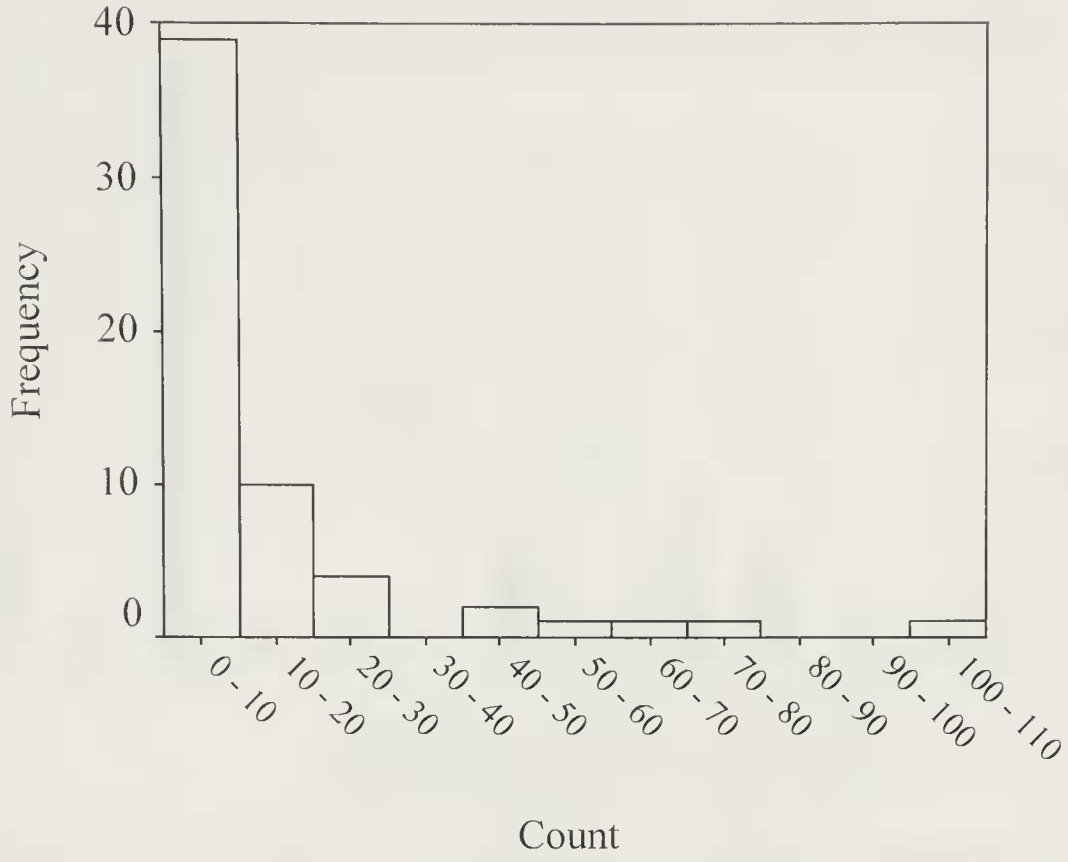

Figure 2. Frequency of *Lampyris noctiluca* female counts in the survey for 2001 and 2002 combined (n = 59)

favourable habitats in Essex may explain the extremely localised distribution of this species.

A total of 745 female *L. noctiluca* were observed on the 12 transects in 2001 and 2002. Counts were generally very low (Fig. 2), for example, the modal count was one female (recorded 15 times). The highest count of the survey was recorded at Site J (One Tree Hill, nr Basildon), where 101 females were observed on 10 July 2002. This site had the greatest abundance of *L. noctiluca* females observed over both years (Fig. 3). Numbers were much lower at the other transect sites, particularly Sites E, G and K. *Lampyris noctiluca* is a predator on snails and slugs in its larval stage and as such, is limited to much lower densities than its prey (Tyler, 1994). Numbers of *L. noctiluca* females are liable to large fluctuations from year to year and natural extinctions of local populations can occur (Tyler, 1986), with small colonies particularly vulnerable.

Individuals in small populations may share many of the same genes due to a high occurrence of inbreeding. The smaller Essex populations may have little genetic variability, which Young (1997) states can lead to less adaptability to environmental conditions. This can lead to reduced fitness and genetic variability (Young, 1997) and could ultimately jeopardise the viability of a colony. This area of *L. noctiluca* ecology urgently needs further research.

Approximately nine sites are known nationally where nightly counts may exceed 100 glowing females (Derbyshire Biological Records Centre, 2003). One count of over 100 females was recorded at Site J during the survey, which underlines the importance of this colony in the county and national context. Fortunately, Site J is managed as a nature reserve and consideration is given to *L. noctiluca* in

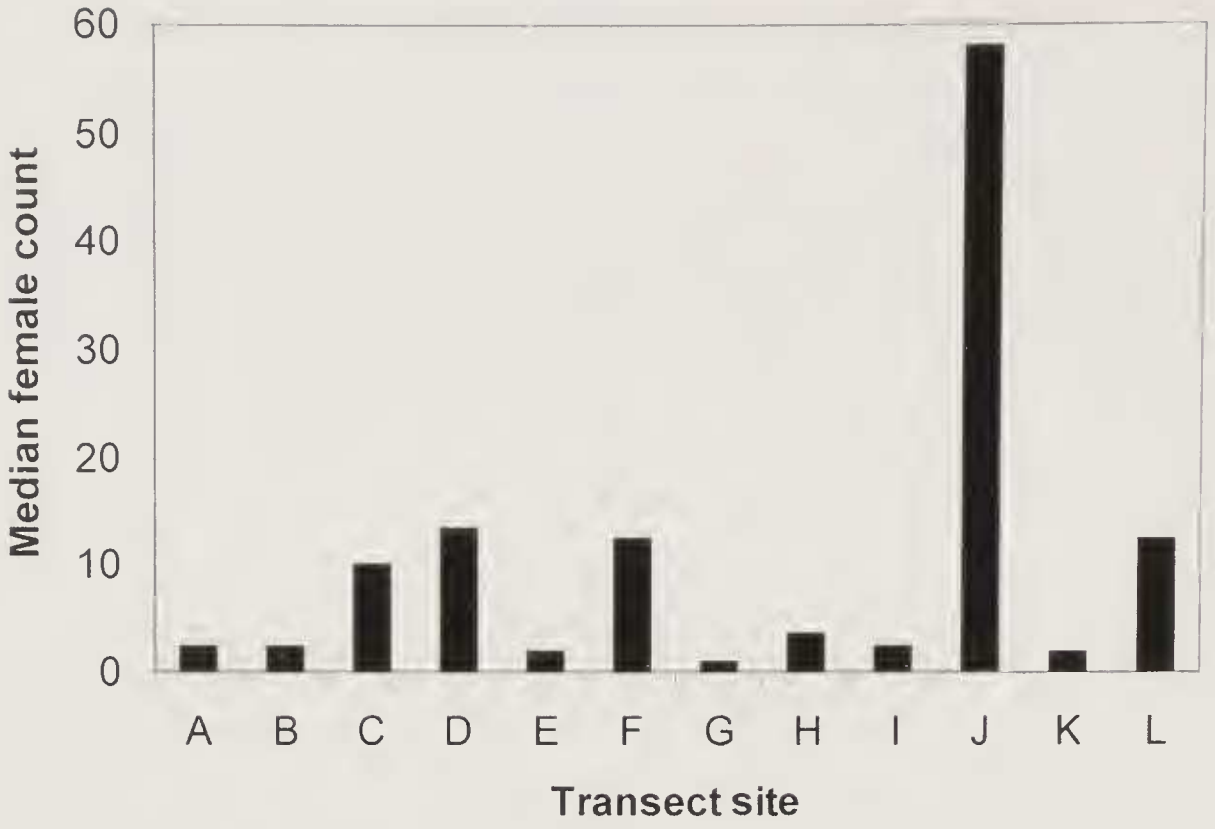

Figure 3. Abundance of *Lampyris noctiluca* females at the 12 transect sites for 2001 and 2002 combined

management planning for this site. Ongoing monitoring of this important colony will continue in the future as any decline in numbers could have serious consequences for the continued presence of this species in the county.

Having determined that most of the colonies in the transect survey are small, it is possible to ascertain which of these populations are most at risk from extinction. This can be achieved through a comparison of the isolation of each colony from the next nearest occupied site and the extent of available favourable habitat in the immediate vicinity. Figure 4 illustrates the level of isolation for each of the 12 transect sites and relates this to the size of available habitat in the immediate vicinity.

There are several colonies (Sites B, C, K and L) which are relatively isolated from the next nearest occupied site (>1 km), and the size of available habitat in the vicinity of these sites is very small (<20 ha) (Fig. 4). Colonies which exist in a relatively limited area of favourable habitat may be more prone to extinction due to random events. For example, the small colony at Site B (Bulford Mill Lane, nr Cressing) occurs on a very narrow roadside verge (only one metre in width), where females have been seen glowing within centimetres of the road. Vehicles regularly park along the grassy portion of the verge, which may destroy favourable habitat and have serious deleterious impacts upon larvae and glowing females. At Site J, the largest colony recorded in the transect survey, a large area of favourable habitat is present in the immediate vicinity (160 ha) and the next nearest colony is not too distant (1.0 km), therefore, the survival of this important Essex population seems relatively secure in the short-term. The *L. noctiluca* colony at Site G (Hatfield Forest) is very small (Fig. 3), but exists in a very large area of favourable habitat (approximately 420 ha). There is plenty of potential for this species to become more widespread and common in the Forest, as the main habitats are unimproved grazed grassland and ancient woodland with wide rides.

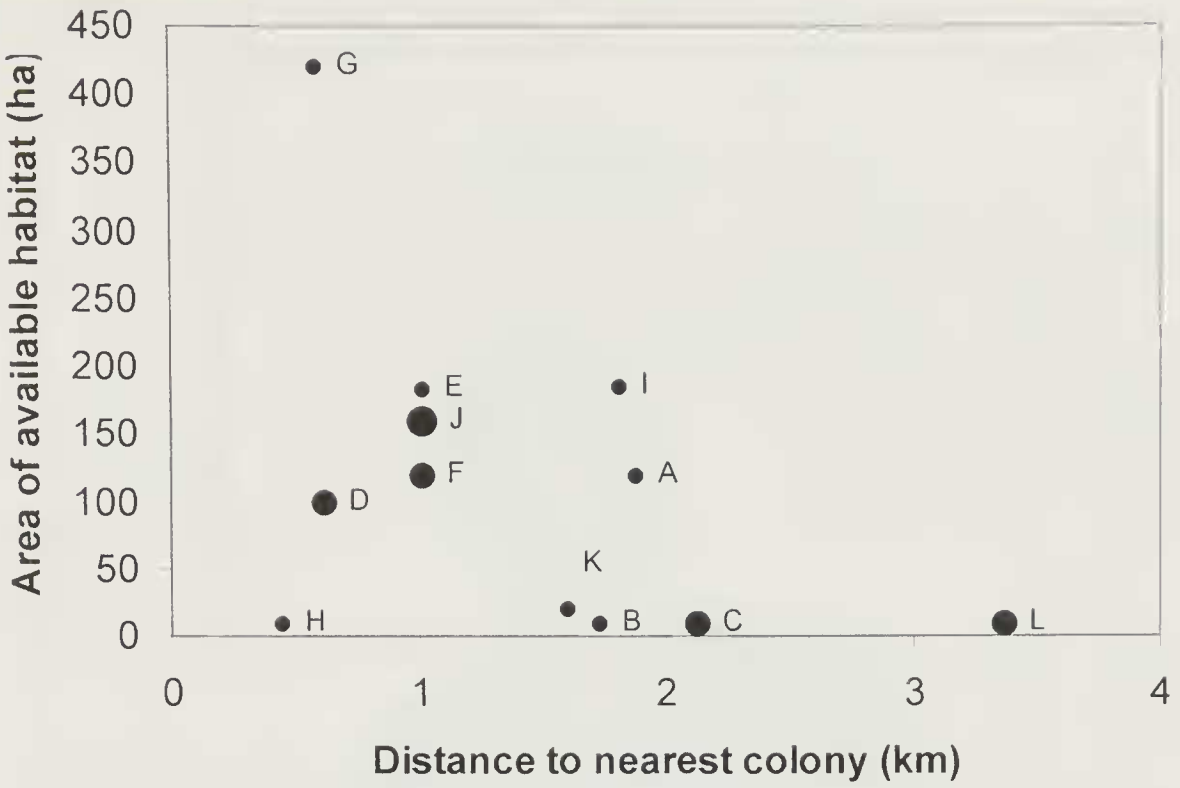

Figure 4 The relationship between colony isolation and habitat availability for each transect site (increasing dot size = increasing median female count)

If colonies such as that found at Site B become extinct, the chances of re-colonisation by individuals from another population are remote. *Lampyris noctiluca* is an extremely sedentary species with very limited dispersal capabilities (Gardiner & Tyler, 2002). Although the winged male is relatively mobile, the adult female is wingless and is completely sedentary during adult life (Tyler, 1986). In a study of marked glowing females, the mean distance travelled between nights was approximately 17 centimetres (Tyler, 2002). Therefore, the ability of *L. noctiluca* to colonise new areas is totally dependent on how far the larva can travel. Tyler (1994) states that a typical larva can travel approximately five metres per hour, although it is not known whether larvae traverse unfavourable habitats such as arable fields. This could have potentially serious consequences for the smaller Essex populations because if a colony becomes extinct either through natural or human intervention, the chances of re-colonisation of the site by larvae from a nearby population is unlikely.

The transect sites will need to be closely monitored in future years to ascertain whether numbers are declining towards extinction.

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BOOK REVIEW

Dragonflies by Steve Brooks. The Natural History Museum, 2002. 96 pp., 95 colour photographs. Paperback. £9.95. ISBN 0-565-09180-8.

Steve Brooks will be known to many odonatists as the author of the *Field Guide to Dragonflies and Damselflies of Great Britain and Ireland*. Steve, who is based at the Natural History Museum, has produced another excellent book entitled simply *Dragonflies*. It is a well balanced, easy to read book, which is very informative and interesting, yet not too scientific or "stuffy". It is beautifully illustrated with many superb colour photographs, including various larvae, a sequence of 6 photographs showing the emergence of a Common Darter *Sympetrum striolatum* (Charpentier) from the larval skin, adult dragonflies from around the world, and a few examples of habitats. Chapter headings include 'What are dragonflies and damselflies?', 'Immature stages', 'Adults', 'Mating', and 'Dragonfly and damselfly diversity', each one covering subjects such as classification, life-cycle, flight, feeding, predators and dispersal. The last chapter 'Odonata and humans', includes useful information on conservation and creating a pond for dragonflies. This is a book for anyone with an interest in wildlife, and especially the amateur odonatist, who wishes to know more about dragonflies; a book that should encourage further study into the fascinating world of Odonates. This latest addition to the Life Series books published by the Natural History Museum will be a useful addition to your collection and I highly recommend it.

JOHN BROOK